

## **DIVISION 2 EARTHWORK**

### **2-01 CLEARING, GRUBBING, AND ROADSIDE CLEANUP**

#### **2-01.1 Description**

The Contractor shall clear, grub, and clean up those areas staked or described in the Special Provisions. This work includes protecting from harm all trees, bushes, shrubs, or other objects selected to remain.

“Clearing” means removing and disposing of all unwanted material from the surface, such as trees, brush, down timber, or other natural material.

“Grubbing” means removing and disposing of all unwanted vegetative matter from underground, such as sod, stumps, roots, buried logs, or other debris.

“Roadside cleanup”, whether inside or outside the staked area, means work done to give the roadside an attractive, finished appearance.

“Debris” means all unusable natural material produced by clearing, grubbing, or roadside cleanup.

#### **2-01.2 Disposal of Usable Material and Debris**

When possible, the Contractor should sell all usable material such as timber, chips, or firewood produced by clearing, grubbing, or roadside cleanup. The Contractor shall not allow the public to fell trees.

The Contractor shall meet all requirements of state, county, and municipal regulations regarding health, safety, and public welfare in the disposal of all debris.

The Contractor shall dispose of all debris by one or more of the three disposal methods described below.

Disposal of debris in a Contractor-provided waste site shall meet the requirements of [Section 2-03.3\(7\)C](#).

#### **2-01.2(1) Disposal Method No. 1 — Open Burning**

The open burning of residue resulting from land clearing is restricted by Chapter 173-425 of the Washington Administrative Code. No commercial open burning shall be conducted without authorization from the Washington State Department of Ecology or the appropriate local air pollution control authority.

Open burning, when permitted, shall be done in a high stack that meets these requirements:

1. Diameter — at least 20-feet.
2. Height — one foot or more for every foot of diameter.
3. Content — clean debris, with stumps free of excess dirt, stacked in well-ventilated piles.
4. Stacking equipment — debris must be stacked and the fire maintained by clamshell or similar equipment, not by bulldozer or front-end loader.
5. Number of stacks — no more than one fire every 200 yards may be burning at one time.
6. Additional debris shall not be added to a burning stack.

**2-01.2(2) Disposal Method No. 2 — Waste Site**

Debris shall be hauled to a waste site obtained and provided by the Contractor in accordance with [Section 2-03.3\(7\)C](#).

**2-01.2(3) Disposal Method No. 3 — Chipping**

Chipping shall be done by machines that can grind debris into wood chips. Wood chips to be sold may be any size. Unsold chips shall be no larger than 6 square inches and no thicker than 1/2-inch. The Contractor shall spread unsold chips evenly on the project site and tractor-walk them into the ground.

Stumps shall be hauled to a waste site obtained by the Contractor.

**2-01.3 Construction Requirements****2-01.3(1) Clearing**

The Contractor shall:

1. Fell trees only within the area to be cleared.
2. Close-cut parallel to the slope of the ground all stumps to be left in the cleared area outside the slope stakes.
3. Close cut all stumps that will be buried by fills 5-feet or less in depth.
4. Follow these requirements for all stumps that will be buried by fills deeper than 5-feet:
  - a. Close-cut stumps under 18-inches in diameter.
  - b. Trim stumps that exceed 18-inches in diameter to no more than 12-inches above original ground level.
5. Leave standing any trees or native growth indicated by the Engineer.
6. Trim all trees to be left standing to the height specified by the Engineer, neatly cutting all limbs close to the tree trunk.
7. Thin clumps of native growth as the Engineer may direct.
8. Protect, by fencing if necessary, all trees or native growth from any damage caused by construction operations.

**2-01.3(2) Grubbing**

The Contractor shall:

1. Grub deep enough to remove all stumps, large roots, buried logs, and other vegetative material.
2. Grub all areas:
  - a. Indicated by the Engineer or by the Special Provisions.
  - b. To be excavated, including area staked for slope treatment.
  - c. Where subdrainage trenches will be dug, unsuitable material removed, or structures built.
  - d. In which hillsides or existing embankments will be terraced as described in [Section 2-03.3\(14\)](#).
  - e. Upon which embankments will be placed, except where the subgrade or slope elevation exceeds 5-feet above the natural ground surface, the Contractor may close cut all trees, stumps, and large roots less than 18-inches in diameter.

A contract may include grubbing without mentioning clearing or roadside cleanup. In that case, the Contractor shall remove and dispose of all upturned stumps and roots of windfalls that lie within the cleared area of the right of way, even though they are outside the area staked for grubbing. Such work shall be incidental to other work covered by the Contract.

### **2-01.3(3) Vacant**

### **2-01.3(4) Roadside Cleanup**

Roadside cleanup, as ordered by the Engineer, consists of work not otherwise provided for in the Contract. Such work may include:

1. Removing trees, snags, down timber, upturned stumps, large rocks and boulders, and other unsightly matter outside the areas staked for clearing or grubbing.
2. Thinning trees or brush.
3. Filling holes, and smoothing and contouring the ground.
4. Shaping the ends of cuts and fills to fit adjacent terrain and to enhance the area's appearance.
5. Obliterating abandoned roads and reshaping the areas to blend naturally with surroundings.

Methods and equipment used in roadside cleanup shall be approved by the Engineer.

### **2-01.4 Measurement**

No unit of measurement shall apply to the lump sum price for clearing and grubbing.

When clearing and grubbing is paid per acre, the following areas will be excluded from measurement:

1. Any area along an existing highway that requires no work.
2. Any gap that requires no work, provided the gap is at least 50-feet long when measured parallel to the center line and contains at least 2,500 square feet.

Isolated areas of less than 2,500 square feet that require work lying between areas excluded from measurement will be counted as having 2,500 square feet. If these isolated areas occur intermittently, the final measurement shall not exceed the total area containing the several isolated areas when measured as continuous.

Clearing and grubbing may be combined in the proposal. If the proposal calls for such combined work to be measured "per acre," the measurement methods described above will apply. If the proposal designates such combined work as "lump sum," the Contracting Agency will not base payment on any unit of measurement.

### **2-01.5 Payment**

Payment will be made in accordance with [Section 1-04.1](#), for the following bid items when they are included in the proposal:

"Clearing and Grubbing," per acre or lump sum.

The unit contract price per acre or lump sum for "Clearing and Grubbing" shall be full pay for all work described in this section except "Roadside Cleanup."

"Roadside Cleanup," by force account as provided in [Section 1-09.6](#).

To provide a common proposal for all bidders, the Contracting Agency has entered an amount in the proposal to become a part of the Contractor's total bid.

## 2-02 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

### 2-02.1 Description

The work described in this section includes removing and disposing of, or salvaging, materials named in the Special Provisions or identified by the Engineer. The work also includes the backfilling of trenches, holes, or pits that result from such removal.

### 2-02.2 Vacant

### 2-02.3 Construction Requirements

With certain exceptions, the Contractor shall raze, remove, and dispose of all buildings and foundations, structures, fences, and other obstructions that lie wholly or partially within the right of way. The exceptions are utility-owned equipment and any other items the Contracting Agency may direct the Contractor to leave intact.

When salvageable material is to remain Contracting Agency property, the Special Provisions will identify the material and describe how the Contractor shall remove it and where it will be stored.

Any material not named in the Special Provisions as Contracting Agency property will become the property of the Contractor and shall be removed from the project.

The Contractor may dispose of waste material in Contracting Agency owned sites if the Special Provisions or the Engineer permits it. Otherwise, the Contractor shall arrange to dispose of waste at no expense to the Contracting Agency and the disposal shall meet the requirements of [Section 2-03.3\(7\)C](#).

#### 2-02.3(1) Removal of Foundations

When removing foundations the Contractor shall:

1. Remove foundations to a depth of at least 5-feet below finished ground elevation or subgrade elevation, whichever is lower.
2. Break up basement floors to promote drainage.
3. Fill basements or other cavities left by the removal of structures. The fill shall match the level of surrounding ground. Fill within the slopes of the roadbed shall be compacted to meet the requirements of [Section 2-03.3\(14\)C](#), Method B.

#### 2-02.3(2) Removal of Bridges, Box Culverts, and other Drainage Structures

When salvaging any steel or wooden bridge that will remain Contracting Agency property, the Contractor shall prevent unnecessary damage to the material. Steel members shall be match-marked.

Unless otherwise directed, the Contractor shall remove foundations of existing structures to a point 2-feet below: the finished ground elevation, the adjacent ground elevation, or the natural stream bottom. If a foundation lies wholly or partially on the site of a new structure, it shall be removed to a level that accommodates building the new structure.

Any blasting shall be subject to the Engineer's approval. The Contractor must complete all blasting before the placement of new work.

**2-02.3(3) Removal of Pavement, Sidewalks, Curbs, and Gutters**

In removing pavement, sidewalks, curbs, and gutters, the Contractor shall:

1. Haul broken-up pieces into the roadway embankment or to some off-project site.
2. Material that is to be incorporated into the embankment shall be broken into pieces not exceeding 18-inches in any dimension, and no part of any piece shall be within three feet of the top, side, or end surface of the embankment or any structure.
3. Make a vertical saw cut between any existing pavement, sidewalk, curb, or gutter that is to remain and the portion to be removed.
4. Replace at no expense to the Contracting Agency any existing pavement designated to remain that is damaged during the removal of other pavement.

**2-02.4 Measurement**

No specific unit of measurement shall apply to the lump sum item of removal of structure and obstruction.

**2-02.5 Payment**

Payment will be made in accordance with [Section 1-04.1](#), for the following bid item when it is included in the proposal:

“Removal of Structure and Obstruction”, lump sum.

If pavements, sidewalks, curbs, or gutters lie within an excavation area, their removal will be paid for as part of the quantity removed in excavation.

## 2-03 ROADWAY EXCAVATION AND EMBANKMENT

### 2-03.1 Description

The work described in this section, regardless of the nature or type of the materials encountered, includes excavating and grading the roadway, excavating in borrow pits, excavating below grade, excavating channels, removing slide material, and disposing of all excavated material. These activities may be performed in making cuts, embankments, slopes, roadway ditches, approaches, parking areas, highway-driveway intersections, and in completing related work.

The work excludes these items if they are designated as pay items in the Contract:

1. Haul.
2. Excavation for structures and ditches.
3. Removal of unsuitable materials.

The Plans may divide the project into separate areas (Roadway Excavation, Area A, Roadway Excavation, Area B, etc.). Such division does not imply any classification of materials in the areas. The boundaries of the areas shall not be changed regardless of how similar or dissimilar the materials are from one area to another.

All work described here must reasonably conform to the alignment, grade, and cross-sections shown in the Plans or established by the Engineer.

### 2-03.2 Vacant

### 2-03.3 Construction Requirements

#### 2-03.3(1) Widening of Cuts

If routine cuts do not supply enough material to form the embankment, the Contractor shall obtain more fill from cuts inside or outside the right of way as the Engineer may direct or from widening one or both sides of existing cuts as designated by the Engineer. In either case, the Contractor shall dress the sides of the cuts to any slopes the Engineer may require. If the Contractor has dressed a cut before the Engineer orders it widened, the Contracting Agency will pay for the resloping as provided in [Section 1-04.4](#).

#### 2-03.3(2) Rock Cuts

**Preserving Rock Below Subgrade.** The Contractor shall take care not to break down, loosen, or damage the rock under the subgrade line, except as provided by [Section 2-03.3\(3\)](#). Normally cuts will be made from the top, lift by lift, to protect the rock bench that will remain. The Contractor shall be responsible for methods used and for any damage caused to the roadbed, regardless of any previous approvals by the Engineer.

**Scaling and Dressing.** To leave rock cuts in a safe, stable condition, the Contractor shall scale and dress them, removing all loose fragments and rocks not firmly fastened to the rock slope. The Contractor shall also remove any overhanging rock the Engineer sees as a hazard to roadway users.

If the Engineer requires it, the Contractor shall remove loose fragments and rocks lying outside the slope stakes. Payment for such extra work shall be by force account as provided in [Section 1-09.6](#). The Contracting Agency will pay for loading and hauling these materials at the unit contract prices that apply or as provided in [Section 1-04.4](#).

**Controlled Blasting.** When blasting to establish slopes  $\frac{1}{2}$  to 1 or steeper, and more than 10 feet high, the Contractor shall use controlled blasting. The Engineer may require the Contractor to use controlled blasting to form the faces of other slopes, even if the slopes could be formed by nonblasting methods.

Controlled blasting refers to the controlled use of explosives and blasting accessories in carefully spaced and aligned drill holes to provide a free surface or shear plane in the rock along the specified backslope. Controlled blasting techniques covered by this specification include presplitting and cushion blasting.

Not less than two weeks prior to commencing drilling and blasting operations or at any time the Contractor proposes to change the drilling and blasting methods, the Contractor shall submit a blasting plan to the Engineer for review. The blasting plan shall contain the full details of the drilling and blasting patterns and controls the Contractor proposes to use for both the controlled and production blasting. The blasting plan shall contain the following minimum information:

1. Station limits of proposed shot.
2. Plan and section views of proposed drill pattern including free face, burden, blast hole spacing, blast hole diameter, blast hole angles, lift height, and subdrill depth.
3. Loading diagram showing type and amount of explosives, primers, initiators, and location and depth of stemming.
4. Initiation sequence of blast holes including delay times and delay system.
5. Manufacturer's data sheets for all explosives, primers, and initiators to be employed.

Review of the blast plan by the Engineer shall not relieve the Contractor of the responsibility for the accuracy and adequacy of the plan when implemented in the field.

When using control blasting the Contractor shall:

1. Prior to commencing full-scale blasting operations, the Contractor shall demonstrate the adequacy of the proposed blast plan by drilling, blasting, and excavating short test sections, up to 100 feet in length, to determine which combination of method, hole spacing, and charge works best. When field conditions warrant, the Contractor may be ordered to use test section lengths less than 100 feet.

Unless otherwise approved by the Engineer, the Contractor shall begin the tests with the controlled blast holes spaced 30-inches apart, then adjust if needed, until the Engineer approves the spacing to be used for full-scale blasting operations.

2. The Contractor shall completely remove all overburden soil and loose or decomposed rock along the top of the excavation for a distance of at least 30 feet beyond the end of the production hole drilling limits, or to the end of the cut, before drilling the presplitting holes.
3. The controlled blast holes shall be not less than  $2\frac{1}{2}$  inches nor more than 3 inches in diameter.
4. The Contractor shall control drilling operations by the use of the proper equipment and technique to ensure that no hole shall deviate from the plane of the planned slope by more than 9 inches either parallel or normal to the slope. Drill holes exceeding these limits shall not be paid for unless satisfactory slopes are being obtained.

5. Controlled blast holes shall extend a minimum of 30 feet beyond the limits of the production holes to be detonated, or to the end of the cut as applicable.
6. The length of controlled blast holes for any individual lift shall not exceed 20 feet unless the Contractor can demonstrate to the Engineer the ability to stay within the above tolerances and produce a uniform slope. If greater than 5 percent of the presplit holes are misaligned in any one lift, the Contractor shall reduce the height of the lifts until the 9-inch alignment tolerance is met. Upon satisfactory demonstration, the length of holes may be increased to a maximum of 60 feet with written approval of the Engineer.
7. When the cut height requires more than one lift, a maximum 2-foot offset between lifts will be permitted to allow for drill equipment clearances. The Contractor shall begin the control blast hole drilling at a point that will allow for necessary offsets and shall adjust, at the start of lower lifts, to compensate for any drift that may have occurred in the upper lifts.
8. Before placing charges, the Contractor shall determine that the hole is free of obstructions for its entire depth. All necessary precautions shall be exercised so that the placing of the charges will not cause caving of material from the walls of the holes.
9. The maximum diameter of explosives used in presplit holes shall not be greater than  $\frac{1}{2}$  the diameter of the presplit hole.
10. Only standard explosives manufactured especially for controlled blasting shall be used in controlled blast holes, unless otherwise approved by the Engineer. Bulk ammonium nitrate and fuel oil (ANFO) shall not be allowed to be loaded in the presplit holes.

If fractional portions of standard explosive cartridges are used, they shall be firmly affixed to the detonating cord in a manner that the cartridges will not slip down the detonating cord nor bridge across the hole. Spacing of fractional cartridges along the length of the detonating cord shall not exceed 30 inches center to center and shall be adjusted to give the desired results.

Continuous column cartridge type of explosives used with detonating cord shall be assembled and affixed to the detonating cord in accordance with the explosive manufacturer's instructions, a copy of which shall be furnished to the Engineer.

11. The bottom charge of a presplit hole may be larger than the line charges but shall not be large enough to cause overbreak. The top charge of the presplitting hole shall be placed far enough below the collar, and reduced sufficiently, to avoid overbreaking and heaving.
12. The upper portion of all presplit holes, from the top most charge to the hole collar, shall be stemmed. Stemming materials shall be sand or other dry angular material, all of which passes a  $\frac{3}{8}$ -inch sieve.
13. If presplitting is specified, the detonation of these holes shall be fired first.
14. If cushion blasting is specified, the detonation of these holes shall be fired last on an instantaneous delay after all other blasting has taken place in the excavation.



15. Production blast holes shall not be drilled closer than 6 feet to the controlled blast line, unless approved by the Engineer. The bottom of the production holes shall not be lower than the bottom of the controlled blast holes. Production holes shall not exceed 6 inches in diameter, unless approved by the Engineer. Detonation of production holes shall be on a delay sequence toward a free face.
16. The use of horizontal blast holes for either production or controlled blasting is prohibited.

### 2-03.3(3) Excavation Below Grade

**Rock Excavation.** When the Contractor finds rock or other hard material at the subgrade elevation, it shall be excavated the full width of the roadbed to at least 6 inches below subgrade, then backfilled with rock fragments, gravel, or other free-draining material not more than 4 inches in diameter.

If the Contractor uses a subgrade trimmer, the backfill shall be rock, gravel, or other free-draining material not more than 2 inches in diameter. The Contractor shall save the finer free-draining material from excavations or borrow pits to use in backfilling the top 6 inches of the subgrade. All such material shall be approved by the Engineer.

**Sub excavation.** At any time, the Engineer may order excavation below subgrade to remove soft and uncompactible material. The replacement material shall be free-draining and granular, or other materials as determined by the Engineer.

**Draining Rock Pockets.** If blasting below subgrade leaves a rock pocket that will not drain, the Contractor shall dig a trench from the pocket bottom to the roadside ditch, then backfill both the pocket and the trench with rock fragments, gravel, or other material approved by the Engineer, at no expense to the Contracting Agency.

**Compaction.** If the density of the natural earth under any area of the roadway is less than that required in [Section 2-03.3\(14\)C](#), Method B, the Engineer may direct the Contractor to:

1. Scarify the earth to a depth of 6 inches.
2. Aerate or water.
3. Compact the scarified area to the required density.
4. Excavate to a specific depth.
5. Backfill the excavated area in layers, using the previously excavated material or other material.
6. Compact each layer to meet the compaction requirements for embankments.

### 2-03.3(4) Sluicing

The Contractor shall not excavate by sluicing unless the Special Provisions specifically call for it.

### 2-03.3(5) Slope Treatment

The tops of all roadway cut slopes, except solid rock cuts, shall be rounded in accordance with the Standard Plan. Unless otherwise noted in the Plans or Special Provisions, Class A slope treatment shall be utilized.

If a layer of earth covers a rock cut, the slope shall be rounded above the rock as if it were an earth slope.

When the Contractor removes stumps or any embedded material from the rounded area, the void shall be backfilled and stabilized to prevent erosion.

All work required to complete slope treatment, including excavation, haul, and slope rounding, shall be included in the unit bid price for roadway excavation.

### **2-03.3(6) Deposit of Rock for the Contracting Agency's Use**

At the Engineer's direction, the Contractor shall deposit excavated rock at the roadside or elsewhere. If this requires the Contractor to use material that would otherwise have gone into an embankment, the Contracting Agency will pay for the extra cubic yards of excavation needed to complete the embankment. Any such rock deposit shall be Contracting Agency property. The Contractor shall be responsible for safekeeping the deposit until the Contracting Agency has removed it or until the contract is completed.

### **2-03.3(7) Disposal of Surplus Material**

#### **2-03.3(7)A General**

The Contractor shall haul all excavation to the nearest embankment unless the Engineer declares the hauling distance to be too great. If excavation yields more material than needed for nearby embankments, the Contractor shall dispose of the excess in keeping with the Special Provisions or as the Engineer directs.

#### **2-03.3(7)B Haul**

When the contract includes a payment item for haul, the Contracting Agency will pay as follows for hauling excess excavation to a disposal site:

1. If the Contracting Agency provides a site, but the Contractor chooses to haul elsewhere, the Contracting Agency will pay for the actual distance up to but not exceeding the distance that would have been necessary using the Contracting Agency site.
2. If the Contracting Agency does not provide a site, the Contracting Agency will pay for the actual distance up to but not exceeding the distance necessary to haul to a site 1 mile from the project limits.

#### **2-03.3(7)C Contractor-Provided Disposal Site**

If the Contracting Agency provides no waste site, but requires disposal of excess excavation or other materials, the Contractor shall arrange for disposal at no expense to the Contracting Agency, except as provided in [Section 2-03.3\(7\)B](#), Item 2.

The Contractor shall acquire all permits and approvals required for the use of the disposal site. The cost of any such permits and approvals shall be included in the bid prices for other work.

The Contractor shall provide the Engineer the location of all disposal sites to be used and also provide copies of the permits and approvals for such disposal sites before any waste is hauled off the project.

Disposal of excess material within a wetland area will not be allowed without a Section 404 permit issued by the U.S. Corps of Engineers and approval by the local agency with jurisdiction over the wetlands. Wetlands are defined as those areas inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

The Contractor shall protect, indemnify, and save harmless the Contracting Agency from any damages that may arise from the Contractor's activities in making these arrangements. Such indemnity shall be in accordance with RCW 4.24.115 as amended by CH. 305, Laws of 1986. Any action required to satisfy any permit and/or any approval requirements in a Contractor provided disposal site shall be performed by the Contractor at no additional expense to the Contracting Agency.

Reclamation of a Contractor-supplied waste site must conform to the requirements of [Section 3-03](#).

### **2-03.3(8) Wasting Material**

If, against the Engineer's orders, the Contractor wastes material needed for the embankment, it shall be replaced at no expense to the Contracting Agency with material the Engineer approves.

### **2-03.3(9) Roadway Ditches**

At each transition from cut to fill, the Contractor shall divert any roadway ditch away from the embankment in natural ground. Ditches shall never permit water to flow into or upon embankment material.

### **2-03.3(10) Selected Material**

When the contract or the Engineer calls for it, selected material shall be used for finishing the top part of the subgrade, for structural or other backfill, or for other purposes. Unless the Special Provisions specify otherwise, the Engineer may identify as "selected" any material excavated within the right-of-way, including the excavation of local borrow.

**Direct Hauling.** If it is practical, the Contractor shall haul selected material immediately from excavation to its final place on the roadbed. The Contracting Agency will pay for such work at the unit contract prices for excavating, hauling, watering, and compacting.

**Delayed Excavation.** If it is impractical to haul selected material to its final place at once, the Contractor shall delay excavation until the placement will be workable. The Contracting Agency will not pay extra for delayed excavation.

**Stockpiling.** The Engineer may allow the Contractor to stockpile selected materials if delaying the excavation will hamper grading or force impractical movements of equipment. In this case, the Engineer will direct where and when the Contractor shall excavate, stockpile, haul, and place the selected materials.

[Sections 2-03.4](#) and [2-03.5](#) describe how the Contracting Agency will measure and pay for excavating and hauling these stockpiled selected materials. The neat line volume of material removed will provide the basis for measuring material taken from the stockpile.

### **2-03.3(11) Slides**

If a slide occurs on a finished slope before final acceptance of the work, the Contractor shall remove or replace the slide material. The Contractor shall also refinish the slope to the condition and with the materials required by the Engineer.

The Contracting Agency will pay for the excavation at the unit contract price and for resloping on a force account basis. The Engineer may authorize payment for the excavation by agreed price or force account if:

1. The slide material cannot be measured accurately; or
2. Excavation of slide material requires equipment not available on the project.

If the Contractor undercuts or destroys a slope, or has failed to implement erosion control devices as shown in the Contract or in the TESC plan, it shall be resloped to the original alignment or to a new one established by the Engineer at no expense to the Contracting Agency.

### 2-03.3(12) Overbreak

Overbreak includes that part of any material excavated, displaced, or loosened outside the staked or reestablished slope or grade. Such material is considered overbreak whether its movement resulted from blasting, from the character of the material itself, or from any other cause. Overbreak, however, does not include material from slides as described in [Section 2-03.3\(11\)](#).

If the Engineer does not approve use of the overbreak, the Contractor shall remove, haul, and dispose of it at no expense to the Contracting Agency. In this case, the Contractor shall follow the procedure for handling surplus described in [Section 2-03.3\(7\)](#).

If the Engineer approves, the Contractor may use overbreak:

1. To complete an embankment when the excavated material unexpectedly falls short of the amount required. The Contracting Agency will pay the roadway excavation contract price for the volume of material the overbreak replaces, and will pay the contract price for haul. However, no payment will be made if overbreak is used when other material is available within the neat lines of the roadway prism.
2. To replace borrow excavation originally planned for an embankment. The Contracting Agency will pay for overbreak used this way at the unit contract price for roadway or borrow excavation, whichever costs less. The Engineer will include haul to be paid as in the original proposal in comparing the costs under the two payment methods.

### 2-03.3(13) Borrow

Borrow is the excavation of material outside the roadway prism or outside the limits of any other excavation area required by the contract. Before any borrow site can be used, it must be measured and approved by the Engineer. Any material excavated from a borrow site before the site is measured will not be paid for. The widening of roadway cuts and ditches will be considered roadway excavation, not borrow.

If the contract documents designate borrow sources, the Contractor may utilize those sources or may obtain borrow from other sites. If borrow is obtained from a Contractor-provided site, there will be no additional cost to the Contracting Agency beyond the contract unit price for the excavated borrow material. There will be no payment for aeration of the borrowed material from a Contractor-provided site, even if the contract contains an item for aeration and even if the contract documents designate borrow sources.

If neither the Plans nor the Special Provisions name a source for borrow, the Contractor shall provide a source at no expense to the Contracting Agency.

The Contractor shall reclaim all borrow sites, Contracting Agency-owned, Contracting Agency-supplied, or obtained by the Contractor, in keeping with [Section 3-03](#).

**2-03.3(14) Embankment Construction**

The Contracting Agency classifies embankment construction as:

1. Rock embankment — in which the material in all or any part of an embankment contains 25 percent or more, by volume, gravel or stone 4 inches or more in diameter. [Section 2-03.3\(14\)A](#).
2. Earth embankment — made of any material other than that used in rock embankment. [Section 2-03.3\(14\)B](#).

**Unstable Base.** If the Engineer believes the natural earth base will impair an embankment or make it unstable, the Contractor shall stabilize or remove and dispose of the base material in keeping with this section or [Section 2-03.3\(14\)E](#).

**Hillside Terraces.** Unless the Engineer directs otherwise, the Contractor shall terrace the original ground or embankment on hillsides, on the sides of existing embankments, and in transitions from cuts to fills. Each terrace shall penetrate the slope at least 5 feet and shall not be more than 5 feet high. The horizontal face of the terrace shall slope outward at approximately 0.05 foot per foot. The Engineer may order the Contractor to place gravel backfill, pipe drains or both to drain any seepage.

All costs for building terraces shall be included in the prices for other work.

**Soft Base.** On wet or swampy ground, the Contractor shall haul and spread embankment material by methods that will disturb the base as little as possible. If the Engineer approves, the Contractor may place the lower part of the fill by dumping and spreading successive loads to form a uniform layer just thick enough to support equipment used to place and compact upper layers.

Normally the Contractor shall not increase the planned depth of the embankment over a soft base merely to permit the use of heavier equipment. But if the Contractor proves that the planned depth will not support light hauling vehicles, the Engineer may approve a deeper fill. The Contractor shall not claim extra pay if these restrictions require the use of lighter equipment or different construction methods than originally planned for use on the soft base.

**2-03.3(14)A Rock Embankment Construction**

The Contractor shall build rock embankments in horizontal layers. No layer shall be deeper than 18 inches unless the rocks in the fill material average more than 18 inches in diameter. The Contractor shall separate and distribute the larger pieces of rock and fill the spaces between them with smaller rocks and earth. With the Engineer's approval, the Contractor may dispose of rocks larger than the average size instead of placing them in the embankment.

**Compacting.** The Contractor shall use a 50-ton compression roller or a vibratory roller having a dynamic force of at least 40,000 pounds impact per vibration and at least 1,000 vibrations per minute. In either case, the roller shall make one full coverage for each 6 inches, or any fraction of 6 inches, of lift depth.

When lift depth is 18 inches or less, the Contractor may use a 10-ton compression roller or a vibratory roller having a dynamic force of at least 30,000 pounds impact per vibration and at least 1,000 vibrations per minute. In either case, the roller shall make four full coverages for each 6 inches, or any fraction of 6 inches, of lift depth.

Rollers must exert reasonably even pressure over the area covered. The Contractor shall limit the speed of compression rollers to no more than 4 miles per hour, and the speed of vibratory rollers to no more than 1.5 miles per hour.

If possible, the Contractor shall compact the material even further by routing empty and loaded hauling equipment evenly over the entire width of the embankment.

When the Engineer believes rolling to be physically impractical, rolling may be omitted on part or all of a layer.

Should excessive moisture threaten the stability of the embankment the Engineer may order the Contractor to alter the operation. This may include alternating layers of wet and dry materials, drying materials before placing, or halting work in the problem areas. In this case the Contracting Agency will not increase payment, but will pay the unit contract prices for the pay items that apply.

**Top Layer.** The Contractor shall build each rock embankment up to 6 inches below subgrade. The top 6-inch layer of embankment shall be of rock, gravel, or other free-draining material that does not exceed 4 inches in diameter. When the Plans require use of a subgrade trimmer, these materials in the top layer may not exceed 2 inches in diameter.

When practical, and as approved by the Engineer, the Contractor shall save the finer free-draining material from excavations or borrow pits for use in topping rock fills. If selected materials suitable for topping are available, the Contracting Agency will pay for them as described in [Section 2-03.3\(10\)](#). If such materials are not available on site, the Contracting Agency will pay for imported materials by including them in the unit contract price for gravel borrow or borrow excavation, each including haul. If the proposal does not include these items, the Contracting Agency will pay as provided in [Section 1-04.4](#).

### 2-03.3(14)B Earth Embankment Construction

The Contractor shall place earth embankments in horizontal layers of uniform thickness. These layers shall run full width from the top to the bottom of the embankment. Slopes shall be compacted to the required density as part of embankment compaction.

During grading operations, the Contractor shall shape the surfaces of embankments and excavations to uniform cross-sections and eliminate all ruts and low places that could hold water. The Contractor shall raise the center of an embankment above the sides. When the surface of an embankment intersects a side hill, the surface shall be sloped away at a rate not to exceed 20:1.

### 2-03.3(14)C Compacting Earth Embankments

This section describes three methods (A, B, and C) for building earth embankments. The Contractor shall use Method B unless the Special Provisions require another method.

**Method A.** Each embankment shall be made of layers no more than 2 feet thick. The Contractor shall compact each layer by routing loaded haul equipment over its entire width. If the Engineer approves, the Contractor may use end dumping to begin placing a side hill fill too narrow for hauling equipment. When the fill is wide enough, the remaining layers shall be compacted by the loaded hauling equipment.

**Method B.** The top 2-feet of each embankment shall be compacted to 95 percent of the maximum density as determined by the compaction control tests described in [Section 2-03.3\(14\)D](#). All material below the 2-foot level shall be compacted to 90 percent of the same maximum density.

In the top 2 feet, horizontal layers shall not exceed 4 inches in depth before compaction. No layer below the top 2 feet shall exceed 8 inches in depth before compaction.

The Contractor shall use compacting equipment approved by the Engineer.

**Method C.** Each layer of the entire embankment shall be compacted to 95 percent of the maximum density as determined by the compaction control tests described in [Section 2-03.3\(14\)D](#).

In the top 2 feet, horizontal layers shall not exceed 4 inches in depth before compaction. No layer below the top 2 feet shall exceed 8 inches in depth before compaction.

The Contractor shall use compacting equipment approved by the Engineer.

Under Methods B or C, the Engineer may permit the Contractor to increase layer thickness up to 18 inches before compaction, provided:

1. The layer is more than 2 feet below the top of the embankment,
2. An approved vibratory roller is used, and
3. The required density is obtained throughout the full depth and width of each layer.

Whatever the method used, any embankment inaccessible to large compacting equipment shall be compacted with small mechanical or vibratory compactors.

**Moisture Content.** Within the limits described below, the Contractor shall adjust moisture content during compaction to produce a firm, stable embankment. The Contractor shall not begin compaction until the moisture content is so adjusted.

Under Method B, the moisture content of the material shall not exceed 3 percent above the optimum determined by the tests described in [Section 2-03.3\(14\)D](#). If the material contains too little moisture to compact properly, the Engineer may order the Contractor to water the material in specific amounts. In this case, the Contracting Agency will pay the unit contract price for water ([Section 2-07](#)).

Under Method C, the moisture content shall not vary more than 3 percent above or below optimum determined by the tests described in [Section 2-03.3\(14\)D](#).

The Engineer may permit the Contractor to place materials having a higher moisture content than specified in this section if:

1. The material consists of free-draining rock, gravel, or sand that produces a firm, stable embankment; and
2. The excess moisture will not impair the embankment.

However, the Engineer may at any time require the Contractor to return to normal moisture-content specifications.

The Contracting Agency will consider all costs of drying embankment material to be incidental to other work. If, however, the Contract includes an aeration item, the Contracting Agency will pay for such work as specified in [Sections 2-03.4](#) and [2-03.5](#).

If weather prevents drying excavation or borrow materials to the required moisture content, the Engineer may order the Contractor to alter normal procedures or equipment to prevent damage to the partial or complete embankment. In this case, the Contracting Agency will not increase payment, but will pay the unit contract prices for the pay items that apply.

The Contractor shall repair at no expense to the Contracting Agency any partial or complete embankment that loses stability because of continued hauling across it. Evidence of lost stability shall include pumping or rutting. The Contractor shall also alter hauling equipment or procedures to prevent further damage.

If it appears that rain or snow will soak an area that has been aerated, the Contractor shall temporarily seal it against the weather. Should the Contractor fail to do so, any additional aeration required to restore the area to its previous condition shall be done at no expense to the Contracting Agency.

### **2-03.3(14)D Compaction and Moisture Control Tests**

Maximum density and optimum moisture content shall be determined by one of the following methods:

1. Materials with less than 30 percent by weight retained on the U.S. No. 4 sieve shall be determined using FOP for AASHTO T 99 Method A.
2. Materials with 30 percent or more by weight retained on the U.S. No. 4 sieve and less than 30 percent retained on the  $\frac{3}{4}$ -inch sieve shall be determined by WSDOT Test Method No. 606 or FOP for AASHTO T 180 Method D. The determination of which test procedure to use will be made solely by the Contracting Agency.
3. Materials with 30 percent or more retained on the  $\frac{3}{4}$ -inch sieve shall be determined by WSDOT Test Method No. 606.

In place density will be determined using Test Methods WSDOT FOP for AASHTO T 310 and WSDOT SOP for T 615.

### **2-03.3(14)E Unsuitable Foundation Excavation**

When the contract or the Engineer requires it, the Contractor shall excavate unstable natural ground before building any embankment over it. This unstable material may include peat, muck, swampland, buried logs and stumps, or other material not fit for an embankment base. The Contractor shall excavate such material to the boundaries set by the Engineer.

The work will not be considered unsuitable foundation excavation if the materials:

1. Came from the roadway cut, ditch, or channel-change prisms.
2. Resulted from structure excavation Class A or B.
3. Are covered in [Section 2-03.3\(3\)](#).

If the Contract provides no bid item for unsuitable foundation excavation, the Contracting Agency will pay as provided in [Section 1-04.4](#).

### **2-03.3(14)F Displacement of Unsuitable Foundation Materials**

If the Contract requires it, the Contractor shall displace or remove any overburden of peat, muck, or other unstable material to permit placing the embankment on underlying firm ground. The Engineer will determine the elevation at which the ground is firm enough to support the embankment.

To displace such material, the Contractor shall use explosives or any other method the Engineer requires. If this work upheaves overburden material outside the slopes of the new fill, the Contractor shall level the material to make it presentable.



The Contracting Agency will pay for the work described in this section by force account. Any other costs related to the work shall be incidental to building the embankment and shall be included in the unit contract prices for the work items that apply.

#### **2-03.3(14)G Backfilling**

When water fills an area after the removal of soft or unstable materials, the Contractor shall, if possible, drain the site so that any backfill may be compacted. If drainage is not possible, the Contractor shall use granular material for backfilling in water, including areas where blasting has displaced the soft material. The Special Provisions may require other backfilling methods.

The costs of pumping or digging temporary drainage ditches shall be incidental to and included in other items of work that apply.

#### **2-03.3(14)H Prefabricated Vertical Drains**

The Contractor shall furnish all necessary labor, equipment and materials, and perform all operations necessary for the installation of prefabricated vertical drains in accordance with the details shown in the Plans and with the requirements of these Specifications.

The prefabricated drain shall consist of a continuous plastic drainage core wrapped in a nonwoven geotextile material as specified in the Contract.

The drains shall be free of defects, rips, holes, or flaws. During shipment and storage, the drain shall be wrapped in a heavy-duty protective covering. The storage area shall protect the drain material from sunlight, mud, dirt, dust, debris, and detrimental substances. Manufacturer certification shall be provided for all drain materials delivered to the project.

Vertical drains shall be staked by the Contractor and constructed prior to embankment construction.

Prior to installation of vertical drains, a sand drainage blanket shall be placed on the ground surface for use as a working platform. This platform shall have a minimum depth of 2 feet and shall consist of uncompacted material meeting the requirements of [Section 9-03.13\(1\)](#).

Vertical drains shall be installed with equipment that will cause a minimum of subsoil disturbance. A mandrel or sleeve shall be advanced through the subsoil using vibratory, constant load, or constant rate of advance methods. The mandrel shall have a maximum cross-sectional area of 14 square inches, shall protect the prefabricated drain material from tears, cuts, and abrasions during installation, and shall be provided with an “anchor” plate or rod. The “anchor” plate or rod shall provide sufficient strength to prevent the soil from entering the bottom during installation and shall anchor the bottom of the drain at the required depth when the mandrel is removed. Use of falling weight impact hammers or jetting will not be allowed within the compressible subsoil to be drained.

The prefabricated drains shall be installed vertically from the working surface to the required elevations and in a sequence that will not require equipment to travel over previously installed drains. The Contractor shall provide the Engineer with a suitable means of verifying the plumbness of the equipment and determining the depth of the drain at any time. The equipment shall not deviate more than 0.25 inches per foot from vertical.

Splices or connections in the prefabricated drain material shall be done in a professional manner to ensure continuity of the wick material. The prefabricated drain shall be cut to leave at least 6 inches protruding above the working platform at each drain location.

Where obstructions are encountered which cannot be penetrated the Contractor shall abandon the hole. A maximum of two attempts shall be made to install a new drain within 18 inches of the obstructed hole. Drains that otherwise deviate from the plan location by more than 6 inches, or that are damaged or improperly installed, will be rejected.

Installation of the drains should consider and be coordinated with the geotechnical instrumentation shown in the Plans. Special care shall be taken when installing drains near instrumentation already in place. Replacement of instrumentation damaged by the Contractor will be the responsibility of the Contractor.

The Contractor shall demonstrate that the equipment, method, and materials produce a satisfactory installation in accordance with these Specifications. For this purpose, the Contractor shall be required to install trial drains at different locations within the work area.

At least two weeks prior to the installation of the drainage wicks, the Contractor shall submit to the Engineer, for review and approval, details of the sequence and method of installation. The submittal shall, at a minimum, contain the dimensions and length of mandrel, a detailed description of the proposed method(s) for overcoming obstructions, and the proposed method(s) for splicing drains.

Approval by the Engineer will not relieve the Contractor of the responsibility to install prefabricated vertical drains in accordance with the Plans, Special Provisions, and these Specifications. If, at any time, the Engineer considers the method of installation does not produce a satisfactory drain, the Contractor shall alter the method and equipment as necessary.

### **2-03.3(14)I Embankments at Bridge and Trestle Ends**

This work consists of filling around the ends of trestles and bridges, the area defined in [Section 1-01.3](#). The Contractor shall begin and complete this work as soon as possible after each bridge is completed or when the Engineer requires.

The Contractor shall select fill material from the excavation sources elsewhere on the project. Bridge approach embankments shall be compacted to at least 95 percent of the maximum density as determined by the tests described in [Section 2-03.3\(14\)D](#). In any embankment area where piles will be installed, the Contractor shall remove all solid material, rocks, broken concrete, etc., larger than 3 inches across that would interfere with pile driving.

To prevent the bridge from being distorted or displaced, the Contractor shall place backfill evenly around all sides and parts of the structure. The Contractor shall not backfill any abutment prior to placing the superstructure. After the superstructure is in place, use of small compactors may be required to compact the backfill around the structure. Embankments and backfill behind the abutments must be brought up in layers and compacted concurrently. The difference in backfill height against each abutment shall not exceed 2 feet unless approved by the Engineer.

The Contractor may request, in writing, approval to place the abutment backfill (either full or partial height) prior to placement of the superstructure. To receive this approval, the Contractor shall submit calculations for the Engineer's review. The calculations shall prove that the abutment is stable, both for overturning and sliding, without the superstructure in place. The stability calculations shall assume a loading of 30 lbs/ft<sup>3</sup> equivalent fluid pressure and include at least a 2-foot surcharge for the backfill placement equipment. If the abutment backfill is allowed to be placed prior to completion of the superstructure, the Contractor shall bear any added cost that results from the change.

The Contractor shall build the embankment under the bridge to the dimensions shown in the Standard Plans or detailed in the Plans.

Cost related to all work described in this section shall be incidental to other work and included in the unit contract prices that apply.

#### **2-03.3(14)J Gravel Borrow Including Haul**

When required by the Plans or the Engineer, the Contractor shall use gravel borrow meeting the requirements of [Section 9-03.14\(1\)](#) to:

1. Build structural embankments.
2. Backfill excavation of unsuitable foundation material above the ground water table.
3. Backfill below-grade excavation above the ground water table.
4. Construct mechanically stabilized earth walls.
5. Construct reinforced soil slopes.

Gravel borrow shall be compacted according to [Section 2-03.3\(14\)C](#) and [2-03.3\(14\)D](#).

#### **2-03.3(14)K Select or Common Borrow Including Haul**

When required by the Plans or the Engineer, the Contractor shall use select borrow meeting the requirements of [Section 9-03.14\(2\)](#), or common borrow meeting the requirements of [Section 9-03.14\(3\)](#) to:

1. Build embankments.
2. Backfill excavation of unsuitable foundation material above the ground water table.
3. Backfill below-grade excavation above the ground water table.

Where specified, select borrow may be used for constructing reinforced slopes.

Select borrow and common borrow shall be compacted according to [Section 2-03.3\(14\)C](#) and [2-03.3\(14\)D](#).

#### **2-03.3(14)L Embankment Widening for Guardrail**

Embankments widened for the installation of beam guardrail shall be terraced. Each terrace shall penetrate the slope 2-feet and shall not be more than 5 feet high. Compaction shall be in accordance with Method A, as specified in [Section 2-03.3\(14\)C](#). Guardrail posts shall not be installed until the embankment widening is completed and compacted.

**2-03.3(14)M Excavation of Channels**

Excavation of channels includes all ditches 8 or more feet wide at the bottom.

Before excavating, the Contractor shall clear and grub the area in accordance with [Section 2-01](#).

**2-03.3(15) Aeration**

The Contracting Agency may include aeration as a contract item if material from test holes in excavation or borrow sites is too wet to compact properly. Even if the Contract includes such an item, the Contractor shall make every effort to reduce the need for aeration. The Contractor shall do so by using methods known to be effective in building embankments with wet materials. Such methods include open ditching to drain excavation areas or alternating layers of wet and dry materials. These and similar methods will be incidental to excavation and their costs shall be included in the unit contract price for roadway excavation, for borrow excavation (including haul), and for haul.

If aeration is not a contract item, its cost shall be incidental to and included in the excavation and embankment items.

**Aeration Equipment.** The Engineer may direct the Contractor to use aeration equipment in these areas: roadway excavation, borrow sites, or embankments. The Contracting Agency does not guarantee the moisture-reducing effectiveness of any single type of equipment. The Engineer may, however, require the use of any type that will best aerate a given area.

If the Contractor uses any of the following types of equipment, it shall meet these minimum requirements:

1. Heavy duty power grader. This machine shall have a moldboard measuring 12 feet long, 24-inches high, and  $\frac{3}{4}$ -inch thick. Each grader shall carry its maximum number of standard scarifier-rippers or discs.
2. Heavy duty gang plow. It shall have at least five 16-inch bottoms. Its tractor shall be able to move no less than  $1\frac{1}{2}$  miles per hour while plowing at least 9 inches deep through fairly wet material.
3. Heavy duty tandem discs. This machine shall cut a swath at least 8 feet wide with discs no less than 28 inches in diameter. Its tractor shall be able to turn fairly wet material at least 6 inches deep while moving at 2 miles per hour or more.
4. Heavy duty self-propelled, rotary pulverizer. This machine shall have paddles attached to a transverse shaft. It shall travel  $1\frac{1}{2}$  miles per hour or more while aerating a swath at least 6 feet wide to a depth of 6 inches.

The Contractor shall not use any aerating equipment listed above in tandem nor use any of this equipment to carry out other bid items of work while aerating.

The Engineer may halt aerating work when weather conditions prevent satisfactory results.

**2-03.3(16) End Slopes**

The Engineer will determine when and where to build end slopes, whether these occur at the beginning or end of a project, at the borders of excavation or embankments, at bridge ends, or elsewhere. The Contractor shall build end slopes not detailed in the

Plans to the line and grade designated by the Engineer regardless of centerline limits shown in the Plans. All work to complete and maintain these end slopes shall be considered as work to be performed under the Contract.

### **2-03.3(17) Snow Removal**

If snow deep enough to interfere with the work covers a cut or an embankment, the Contractor shall remove and deposit it outside the slope stakes. Snow removal must be done at least 100-feet ahead of excavation and embankment work. The Contractor shall remove snow at no expense to the Contracting Agency.

### **2-03.3(18) Stepped Slope Construction**

When the Plans or the Engineer requires it, the Contractor shall shape slopes cut in soft rock to a stepped pattern conforming closely to the typical cross-section in the Plans. Stepped slopes shall meet these requirements:

1. Each step shall be 1 to 2-feet high.
2. The horizontal depth of each step will depend on its relationship to the staked slope ratio. The approximate midpoint of each horizontal tread shall occur on the staked slope line.
3. The treads shall be approximately level in all directions.
4. The ends of the steps shall be blended into the natural ground, with loose material removed from transitional areas.
5. If the Contractor cannot rip a rock outcropping within a cut, the steps shall be blended into the rock.
6. Large rocks and material that may fall into the ditch line or onto the roadway shall be removed, but scaling is not required.

The compaction and seeding requirements of [Section 8-01.3\(2\)](#) shall not apply to stepped slope construction.

The Contracting Agency will measure stepped slope excavation by the area defined by the staked slope line. The unit contract price per cubic yard for roadway or borrow excavation shall be full pay for all labor and equipment required to build stepped slopes.

### **2-03.4 Measurement**

“Roadway Excavation”, “Roadway Excavation Incl. Haul”, “Roadway Excavation – Area \_\_\_\_”, “Roadway Excavation Incl. Haul – Area \_\_\_\_” “Unsuitable Foundation Excavation”, and “Common Borrow Incl. Haul” will be measured by the cubic yard. All excavated material will be measured in the position it occupied before the excavation was performed. An original ground measurement will be taken using cross-section or digital terrain modeling survey techniques. For Roadway Excavation items, the original ground will be compared with the planned finished roadway section shown in the plans. Slope/ground intercept points defining the limits of the measurement will be as staked. For Unsuitable Foundation Excavation and Common Borrow items, the original ground will be compared with a survey of the excavation area taken after the work is completed. When the Contracting Agency requires excavated material to be stockpiled, re-excavated and moved again, a second measurement will be made, adding quantity for the same item used in the original excavation. The second measurement will be a comparison of the original cross-section of the stockpile with a cross-section of the stockpile area after the second excavation is completed. If the excavation item does not include Haul, then the measurement provisions of [Section 2-04](#) shall apply.

“Gravel Borrow Incl. Haul” and “Select Borrow Incl. Haul” will be measured by the cubic yard or ton. Measurement by cubic yard will be made in the hauling vehicle.

“Sand Drainage Blanket” will be measured by the ton with deductions made for the weight of moisture above 8 percent.

“Embankment Compaction” (Methods B and C in [Section 2-03.3\(14\)C](#)) will be measured by the cubic yard. An original ground measurement will be taken using cross-section or digital terrain modeling survey techniques. Quantities will be determined based on a comparison of the original ground measurement with the finished embankment section as staked. No allowance will be made for material that settles. No deduction will be taken for other items constructed within the embankment (bridge abutments, piers, columns, backfill, pipes, etc.). The Contracting Agency will exclude from compaction measurement material that is wasted or placed under water and not compacted in layers as provided by [Sections 2-03.3\(14\)A](#) and [2-03.3\(14\)C](#). In cuts, where excavation has been made below the planned subgrade elevation, and in fills where excavation has been made below original ground, compaction will be measured by the cubic yard in the cross-section of compacted backfill material. When material below grade in cuts or in original ground beneath fills is scarified and recompacted, embankment compaction will be measured by its compacted depth, up to a maximum of 6-inches. There is no specific unit of measure and no measurement will be made for method A compaction as described in [2-03.3\(14\)C](#).

No specific unit of measure will apply to the force account item of “Aeration”.

“Controlled Blasting of Rock Face” will be measured by the linear foot of hole drilled. Holes will be measured from the top of the rock surface to the elevation of the roadway ditch or to a bench elevation set by the Engineer. Quantities shown in the Plans are based on 30-inch hole spacing. Actual quantities will depend on field conditions and results from test sections.

“Prefabricated Vertical Drains” will be measured by the linear foot. Trial drains will be measured and included in the payment quantity for the “Prefabricated Vertical Drains”. The drains will be measured from the top of the working platform to the bottom of each hole.

### 2-03.5 Payment

Payment will be made in accordance with [Section 1-04.1](#), for each of the following bid items that are included in the proposal:

“Roadway Excavation”, per cubic yard.

“Roadway Excavation Incl. Haul”, per cubic yard.

“Roadway Excavation – Area \_\_\_\_”, per cubic yard.

“Roadway Excavation Incl. Haul – Area \_\_\_\_”, per cubic yard.

The unit contract price per cubic yard for “Roadway Excavation”, “Roadway Excavation Incl. Haul”, “Roadway Excavation – Area \_\_\_\_” and “Roadway Excavation Incl. Haul – Area \_\_\_\_” shall be full compensation for all costs incurred for excavating, loading, placing, or otherwise disposing of the material. For haul, the unit contract price as provided in [Section 2-04](#) shall apply, except when the pay item is shown as including haul. In that case the unit contract price per cubic yard shall include haul.

When the Engineer orders excavation below subgrade, unit contract prices shall apply, unless the work and/or the equipment to perform the work differs materially from the excavation above subgrade, then payment will be in accordance with [Section 1-04.4](#).

“Unsuitable Foundation Excavation”, per cubic yard.

“Unsuitable Foundation Excavation Incl. Haul”, per cubic yard.

The unit contract price per cubic yard for “Unsuitable Foundation Excavation” and “Unsuitable Foundation Excavation Incl. Haul” shall be full payment for all costs incurred for excavating, loading, and disposing of the material. For haul, the unit contract price as provided in [Section 2-04](#) shall apply, except when the bid item is shown as including haul. In that case, the unit contract price per cubic yard shall include haul.

“Common Borrow Incl. Haul”, per cubic yard.

The unit contract price per cubic yard for “Common Borrow Incl. Haul” shall be full compensation for all costs incurred for excavating, loading, hauling, placing, or otherwise disposing of the material. The unit contract price includes removing, disposing of, wasting, or stockpiling any material in the borrow site that does not meet the specifications for “Common Borrow”.

“Select Borrow Incl. Haul”, per ton.

“Select Borrow Incl. Haul”, per cubic yard.

“Gravel Borrow Incl. Haul”, per ton.

“Gravel Borrow Incl. Haul”, per cubic yard.

“Sand Drainage Blanket”, per ton.

The unit contract price per ton or cubic yard for “Select Borrow Incl. Haul”, “Gravel Borrow Incl. Haul” and “Sand Drainage Blanket” shall be full compensation for all costs incurred for excavating, loading, hauling, and placing the material unless otherwise specified in the proposal.

“Embankment Compaction”, per cubic yard.

The unit contract price per cubic yard for “Embankment Compaction” shall be full compensation for all costs incurred for all material, labor, tools, equipment, and incidentals required.

When embankments are constructed using Method A compaction, payment for embankment compaction will not be made as a separate item. All costs for embankment compaction shall be included in other bid items involved.

If the bid item “Embankment Compaction” is not provided in the proposal, compensation for costs incurred to perform the work described in [Section 2-03.3\(14\)](#), Embankment Construction, shall be included in payment for other items of work in the contract.

“Aeration”, by force account.

“Aeration” will be paid for by force account as specified in [Section 1-09.6](#). The payment for aeration and other related unit contract prices shall be full compensation for all costs incurred to perform the work described in [Section 2-03.3\(15\)](#). Should the Contractor fail to seal an aerated area prior to inclement weather, additional aeration to restore the area to its previous condition shall be at the Contractor’s expense.

For the purpose of providing a common proposal for all bidders, the Contracting Agency has entered an amount in the proposal to become a part of the total bid by the Contractor.

“Controlled Blasting of Rock Face”, per linear foot.

The unit contract price per linear foot for “Controlled Blasting of Rock Face” shall be full compensation for all costs incurred to perform the work described in [Section 2-03.3\(2\)](#). Measurement and payment for roadway excavation and haul related to blasting shall be as provided under those items in this section and shall include the volume of material excavated from the benches or setbacks approved for drilling separate lifts.

“Prefabricated Vertical Drain”, per linear foot.

The unit contract price per linear foot shall be full compensation for all costs incurred to perform the work, including trial drains, as described in [Section 2-03.3\(14\)H](#).



## 2-04 HAUL

### 2-04.1 Description

This work consists of transporting excavated material from its original site to its final place in the work.

The balance points shown in the Plans are only approximate. The Engineer may change the balance points to help equalize quantities of materials or to dispose of surpluses.

When the Plans require hauling, the Contractor shall not substitute wasting or borrowing. The Contracting Agency will not pay extra for cross-hauling unless the Engineer so orders.

### 2-04.2 Vacant

### 2-04.3 Vacant

### 2-04.4 Measurement

The Contracting Agency will measure haul in units of haul where one unit equals 100 cubic yards of excavated material hauled 100 feet.

Excavated material will be measured in its original position. The Engineer will provide a copy of the location mass diagram upon request.

**Haul On Right of Way.** To compute units of haul, the Contracting Agency will measure haul distance parallel to the centerline (or base line) of the highway. Lateral distance (cross-hauling) will not be measured.

Quantities to be measured in this way include: (1) material from the roadway prism or prisms, (2) borrow from widened cuts, (3) waste deposited in the right of way or alongside it, and (4) material from auxiliary lanes — frontage roads, speed change lanes, paralleling and loop ramps, cross roads, and other lanes that supplement through-traffic movements.

If the Plans show more than one centerline or base line (as in a multi-lane highway), the Plans or Special Provisions will describe the line by which haul will be computed.

**Waste Haul Off Right of Way.** The Contracting Agency will measure the cross-section and length of any waste embankment to calculate waste quantities. If the Plans or Special Provisions do not specify a haul route, the Contracting Agency will compute haul along the long axis of the waste embankment, thence along a line running perpendicular to the highway center line, starting at the center line and ending at the nearest end of the waste embankment.

However, when a route is specified, haul distance will be measured along that route. If the Contractor chooses to use a route shorter than that computed or specified, the Contracting Agency will base payment on the length of the route actually used.

### 2-04.5 Payment

Payment will be made in accordance with [Section 1-04.1](#), for the following bid item when it is included in the proposal:

“Haul”, per unit.

2-05 VACANT

## 2-06 SUBGRADE PREPARATION

### 2-06.1 Description

This work consists of preparing graded roadbed for surfacing or surfaced roadbed for paving.

### 2-06.2 Vacant

### 2-06.3 Construction Requirements

#### 2-06.3(1) Subgrade for Surfacing

In preparing the roadbed for surfacing, the Contractor shall:

1. Remove from the roadbed, immediately before placing surfacing materials, all brush, weeds, vegetation, grass, and other debris.
2. Dispose of all debris as the Engineer directs.
3. Drain water from all low spots or ruts.
4. Shape the entire subgrade to a uniform surface running reasonably true to the line, grade, and cross-section as staked.
5. If necessary, the Contractor shall process the subgrade in cut areas to remove materials too coarse for mechanical trimming and recompaction.
6. Compact the subgrade to a depth of 6 inches. Compaction shall achieve 95 percent of the maximum density determined under the tests described in [Section 2-03.3\(14\)D](#). If the underlying material is too soft to permit proper compaction of the subgrade, the Contractor shall loosen, aerate (or excavate and remove), and compact the subgrade until the top layer can be compacted as required.
7. Remove excess material that does not drift to low spots during grading and shaping. The Contractor shall dispose of this excess by placing it where the subgrade lacks material or by wasting it, as the Engineer directs.
8. Add materials as the Engineer directs where the subgrade needs more to bring it up to grade. The Contractor shall water and compact these added materials as needed to produce a true finished subgrade.

If the contract requires a trimming machine, it shall:

1. Maintain the grade and transverse slopes automatically through sensors that respond to reference lines on both edges of each roadway.
2. Create a smooth, uniform surface free from chatter and ripples.

#### 2-06.3(2) Subgrade for Pavement

Before any paving is placed, the Contractor shall bring the subgrade to the required line, grade, and cross-section. The Contractor shall compact the subgrade to a depth of 6 inches to 95 percent standard density as determined by the compaction control tests for granular materials. The compacted area shall be wide enough to let paving machines operate without visible distortion of surfacing material.

The Contractor shall maintain the subgrade in the required condition until the pavement is placed. The Contractor may remove material just before paving if the Plans require thicker areas of pavement.

## 2-06.4 Vacant

## 2-06.5 Measurement and Payment

### 2-06.5(1) Subgrade Constructed Under Same Contract

**Surfacing or Treated Base.** If the Contractor builds a subgrade for surfacing or treated base, the Contracting Agency will consider subgrade preparation as part of the construction work. In this case, measurement and payment will conform to [Section 2-03](#). Such payment shall be the full price for all subgrade preparation work.

**Pavement.** If the Contractor builds a subgrade for pavement, the Contracting Agency will follow the criteria in [Section 5-04](#) (for HMA pavement) or [Section 5-05](#) (for cement concrete pavement) to measure and pay for materials used to prepare the subgrade. The Contracting Agency will measure and pay for water as specified in [Section 2-07](#).

### 2-06.5(2) Subgrade Not Constructed Under Same Contract

When the Contractor prepares an existing subgrade for surfacing (one not built under the present contract), the Contracting Agency will measure and pay for the work by these criteria:

1. **Final Conditioning.** All the following work on the subgrade shall be included in other contract bid items: clearing vegetation and other debris, draining water, smoothing to prepare for staking, grading, shaping, and compacting to a 6-inch depth to final line, grade, and cross-section.
2. **Excess Materials.** If the Contractor must dispose of excess materials during grading and shaping, the Contracting Agency will measure and pay for the work as roadway excavation. If the contract includes no pay item for roadway excavation, the Contracting Agency will measure and pay as provided in [Section 1-04.4](#).
3. **Added Materials.** If the subgrade requires more materials, the Contracting Agency will pay the unit contract price for each kind of material the Contractor provides. The unit contract price shall be full pay for furnishing, placing, and compacting the materials. When unit contract prices do not apply, the Contracting Agency will measure and pay for the work as provided in [Section 1-04.4](#).
4. **Excavation and Backfill.** If the Engineer orders the Contractor to excavate unstable spots in the subgrade, the Contracting Agency will measure and pay for the work as roadway excavation. If the contract does not include roadway excavation as a pay item, payment will be by agreed price or force account. The Contracting Agency will pay unit contract prices for suitable backfill material when included in the contract and will pay as provided in [Section 1-04.4](#) when not included.
5. **Subgrade Protection.** No payment shall be made for protecting the subgrade.

**2-07 WATERING****2-07.1 Description**

This work consists of furnishing, hauling, and applying water for compacting embankments, constructing subgrade, placing of crushed surfacing, dust control, and as the Engineer requires.

**2-07.2 Vacant****2-07.3 Construction Requirements**

The Contractor shall apply water by means of tank trucks equipped with spray bars. Spray controls shall ensure that the water flows evenly and in the amounts required by the Engineer. The Engineer may direct that the Contractor apply water at night or early in the morning to reduce evaporation losses.

**2-07.4 Measurement**

Water shall be measured by tanks or tank trucks of known capacity or by meters approved by the Engineer. The Contractor shall supply and install any meters at no expense to the Contracting Agency.

**2-07.5 Payment**

Payment will be made in accordance with [Section 1-04.1](#), for the following bid item when it is included in the proposal:

“Water”, per M gal.

The unit contract price per M gallon for “water” shall be full pay for all labor, materials, tools, and equipment necessary to furnish, haul, and apply the water.

When the contract does not include water as a pay item, providing and applying the water shall be incidental to construction. All costs shall be included in the other contract pay items.

2-08 VACANT

## 2-09 STRUCTURE EXCAVATION

### 2-09.1 Description

Structure excavation consists of excavating and disposing of all natural material or man-made objects that must be removed to make way for bridge foundations, retaining walls, culverts, trenches for pipelines, conduits, and other structures as shown in the Plans.

This work also includes, unless the contract provides otherwise, removing whole or partial structures, grubbing structure sites that would not otherwise be grubbed, building and later removing shoring, cofferdams, or caissons, pumping or draining excavated areas, protecting excavated materials from the weather, and placing and compacting backfill.

### 2-09.2 Materials

Materials shall meet the requirements of the following sections:

Portland Cement	9-01
Fine Aggregate for Portland Cement Concrete	9-03.1(2)
Admixture for Concrete	9-23.6
Fly Ash	9-23.9
Ground granulated Blast Furnace Slag	9-23.10
Water	9-25

### 2-09.3 Construction Requirements

#### 2-09.3(1) General Requirements

All structure excavation, trenching, and shoring shall be performed in strict compliance with Chapter 296-155 WAC as well as all other applicable local, Contracting Agency, and Federal laws and regulations.

#### 2-09.3(1)A Staking, Cross-Sectioning, and Inspecting

The Contractor shall not begin excavating until after the stakes have been set to locate and/or outline the structure and taken cross-sections to determine how much material to remove. The Engineer will occasionally inspect material taken from and material remaining in the excavation.

#### 2-09.3(1)B Depth of Excavation

The Contractor shall excavate foundation pits to the depth the Plans require, or to any revised depth ordered by the Engineer.

#### 2-09.3(1)C Removal of Unstable Base Material

When the material at the bottom of an excavation is not stable enough to support the structure, the Contractor shall excavate below grade and replace the unstable material with gravel backfill.

Gravel backfill shall meet the requirements of [Section 9-03.12](#). It shall be placed in layers not more than 6 inches thick with each layer compacted to 95 percent of the maximum density determined by the Compaction Control Test, [Section 2-03.3\(14\)D](#).

**2-09.3(1)D Disposal of Excavated Material**

The Engineer may direct the Contractor to dispose of excavated material in embankments, backfills, or remove it from the site.

All costs for disposing of excavated material within the project limits shall be included in the unit contract price for structure excavation, Class A or B. If, however, the Contractor must load and haul the material to a disposal site, the Contracting Agency will pay as provided in [Section 1-04.4](#) for loading and hauling. The Contracting Agency will not pay for handling at the disposal site. Any such disposal shall meet the requirements of [Section 2-03.3\(7\)C](#).

If the contract includes structure excavation, Class A or B, including haul, the unit contract price shall include all costs for loading and hauling the material the full required distance.

**2-09.3(1)E Backfilling**

The backfilling of openings dug for structures shall be a necessary part of and incidental to the excavation. Unless the Engineer directs otherwise, backfill material shall be nonclay material containing no pieces more than 3 inches across, no frozen lumps, and no wood or other foreign material.

When specified in the contract or when approved by the Engineer, the Contractor shall supply controlled density fill as backfill material.

**Alternative Sources.** When material from structure excavation is unsuitable for use as backfill, the Engineer may: require the Contractor to use other material covered by the contract if such substitution involves work that does not differ materially from what would otherwise have been required; require the Contractor to substitute selected material in accordance with [Section 2-03.3\(10\)](#); require the Contractor to use controlled density fill; or require the Contractor to obtain material elsewhere. Material obtained elsewhere will be paid for in accordance with [Section 1-04.4](#).

Controlled Density Fill (CDF) or Controlled Low Strength Material (CLSM) is a ready mixed flowable fill and shall be a blend of cement, sand, water, any necessary admixtures and fly ash or ground granulated blast furnace slag. CDF shall be designed as a low strength, flowable material requiring no subsequent vibration or tamping to achieve 100% consolidation.

CDF shall be designed to have a minimum 28-day strength of 100 psi and a maximum 28-day strength not to exceed 275 psi.

Test for 28-day compressive strength shall be done in accordance with ASTM D-4832. Test for unit weight, yield, cement content, and air content shall be done in accordance with ASTM D 6023. Test for slump shall be in accordance with WSDOT FOP for AASHTO T 119. The water/cement ratio shall be calculated on the total weight of cementitious material. The following are considered cementitious materials: Portland cement, fly ash, ground granulated blast furnace slag and microsilica. The use of air entrainment, air generators, or foaming agents may be needed to meet the performance specifications.

As an alternate to the above contractor proposed CDF mix designs the following CDF mix design may be used.



Controlled Density Fill (CDF)		
Ingredients	Amount per cubic yard	Specific Gravity
Portland Cement	50 lb.	3.15
Fine Aggregate Class 1 or 2	3,300 lb. (3,500 lb. if Fly Ash Class C is used)	2.67
Air Entrainment Admixture	Per manufacturer's recommendations	
Fly Ash Class F or	300 lb.	2.2
Fly Ash Class C	150 lb.	2.2
Water	300 lb. (maximum)	1.0

The contractor shall provide a mix design in writing to the Engineer. No CDF shall be placed until the Engineer has reviewed the mix design. The CDF consistency shall be flowable (approximate slump 3 to 10-inches). CDF shall meet the requirements of [Section 6-02.3\(5\)C](#) and shall be accepted based on a Certificate of Compliance. The producer shall provide a Certificate of Compliance for each truckload of controlled density fill. The Certificate of Compliance shall verify that the delivered material is in compliance with the mix design and shall include:

Agency Contract No.

Date

Truck No.

Batched Weights of Each Ingredient

The certification shall be signed by a responsible representative of the producer, other than the driver, affirming the accuracy of the information provided.

**Stockpiling.** The Engineer may require the Contractor to selectively remove and stockpile any usable material excavated for a structure. If this material meets the requirements for gravel backfill for walls it may replace gravel as wall or abutment backfill.

If the Contractor stockpiles excavated material for use as backfill, it shall be protected with plastic sheeting or by some other method from contamination and weather damage. If the material becomes too wet or contaminated in the stockpile, the Contractor shall dispose of and replace it with an equal amount of suitable material, all at no expense to the Contracting Agency. All costs for storing, protecting, rehandling, and placing stockpiled material shall be included in the unit contract price for structure excavation, Class A or B.

**Compaction.** Backfill from structure excavation shall be placed and compacted in keeping with the following requirements:

1. Backfill supporting roadbed, roadway embankments, or structures — placed in horizontal layers no more than 6 inches thick with each layer compacted to 95 percent of the maximum density determined by the Compaction Control Test, [Section 2-03.3\(14\)D](#).
2. Gravel backfill for drains — placed in horizontal layers no more than 12 inches thick, with each layer compacted by at least three passes of a vibratory compactor approved by the Engineer.
3. All other structure excavation backfill — placed in layers no more than 2 feet thick (loose), with each layer tamped and graded so that final settling will leave the backfill flush with surrounding ground.

4. Compaction of controlled density fill will not be required.

**Timing.** Backfill shall not be placed against any concrete structure until the concrete has attained 90 percent of its design strength and a minimum age of 14 days, except that reinforced concrete retaining walls 15-feet in height or less may be backfilled after the wall has attained 90 percent of its design compressive strength and curing requirements of [Section 6-02.3\(11\)](#) are met. Footings and columns may be backfilled as soon as forms have been removed, so long as the backfill is brought up evenly on all sides.

The Engineer may order the Contractor to use lean concrete in backfilling around piers and in front of abutments and walls. The Contracting Agency will pay for such backfilling as provided in [Section 1-04.4](#).

If water prevents the Contractor from properly placing and compacting backfill, it shall be removed by pumping or other means.

All costs not defined in this section that relate to providing, placing, and compacting backfill shall be at the Contractor's expense.

### **2-09.3(1)F Items to Remain**

If the Contractor damages or removes pavement or anything else meant to remain outside the excavation area, it shall be repaired or replaced at no expense to the Contracting Agency.

### **2-09.3(2) Classification of Structure Excavation**

1. **Class A.** Structure excavation required for bridge and retaining wall footings, pile caps, seals, and wingwalls shall be classified as structure excavation Class A. If the excavation requires a cofferdam, structural shoring, or extra excavation, the work outside the neat lines of the structure excavation Class A shall be classified as shoring or extra excavation Class A.
2. **Class B.** All other structure excavation shall be Class B. If this excavation requires cofferdams, shoring, or extra excavation, the work outside the neat lines of the structure excavation Class B shall be classified as shoring or extra excavation Class B.

### **2-09.3(3) Construction Requirements, Structure Excavation, Class A**

#### **2-09.3(3)A Preservation of Channel**

When foundations or substructures are to be built in or next to running streams, the Contractor shall:

1. Excavate inside cofferdams, caissons, or sheet piling unless dredging or open pit excavation is permitted.
2. Backfill foundations placed inside cofferdams and behind sheet piling prior to removing cofferdams or sheet piling. This backfill shall be level with the original streambed and shall prevent scouring.
3. Remove any excavation material that may have been deposited in or near the stream so that the watercourse is free from obstruction.
4. Maintain water depth and horizontal clearances required for traffic to pass on navigable streams, furnishing any channel signals or lights required during construction.
5. Place riprap around the outside of cofferdams, as specified, to repair local scour.

**2-09.3(3)B Excavation Using Open Pits — Extra Excavation**

The Contractor may dig open pits or perform extra excavation without shoring or cofferdams, if:

1. Footings can be placed in dry material away from running water.
2. The integrity of the completed structure and its surroundings is not reduced.
3. Worker safety is ensured as required by law.
4. The excavation does not disturb the existing pavement or any other adjacent facilities.

If a slide occurs in an open pit, the Contractor shall remove the slide material. If the slide disturbs an area over which a highway will be built, the Contractor shall backfill and compact the site to the original ground line as the Engineer directs. The Contractor shall pay all costs related to removing slide material and restoring a slide area.

The Contractor shall drain or pump any water from the pit, taking care not to stir up or soften the bottom. If equipment in the pit or inadequate water removal makes the foundation material unstable, the Contractor shall, at no expense to the Contracting Agency, remove and replace it with material the Engineer approves.

When the Engineer believes ground water flow may impair a concrete footing, the Contractor shall place under it a layer of gravel at least 6 inches thick. Before placing the gravel, the Contractor shall excavate to whatever grade the Engineer requires. This provision shall not apply to the building of concrete seals.

The Contractor may omit forms when the earthen sides of a footing excavation will stand vertically. In this case, the Contractor may excavate to the neat line dimensions of the footing and pour concrete against the undisturbed earth. If the hole is larger than neat line dimensions, the Contractor shall bear the cost of the extra concrete.

**2-09.3(3)C Preparation for Placing Foundations**

When a foundation will rest on rock, excavation shall penetrate it at least 1 foot, or more if the plans require, to form a key for the footing. The Contractor shall cut the bottom of the excavation to a firm surface, level, stepped, or serrated as the Engineer directs, and remove all loose material.

For an arch abutment, the back face shall be trimmed to true lines so that concrete can be poured against undisturbed material.

If concrete will rest on any excavated surface other than solid rock, the Contractor shall not disturb the bottom of the excavation. The Contractor shall also remove all loose or soft material just before pouring the concrete.

Upon completing any foundation excavation, the Contractor shall notify the Engineer. No concrete or other permanent part of the structure may be placed until the Engineer has given permission to proceed.

**2-09.3(3)D Shoring and Cofferdams**

**Definitions.** Structural shoring is defined as a shoring system that is installed prior to excavation. Structural shoring shall provide lateral support of soils and limit lateral movement of soils supporting structures, utilities, railroads, etc., such that these items are not damaged as a result of the lateral movement of the supporting soils.

Structural shoring systems includes driven cantilever sheet piles, sheet piles with tiebacks, sheet pile cofferdams with wale rings or struts, prestressed spud piles, cantilever soldier piles with lagging, soldier piles with lagging and tiebacks, and multiple tier tieback systems.

Trench boxes, sliding trench shields, jacked shores, and shoring systems that are installed after excavation are not allowed as structural shoring.

A cofferdam is any watertight enclosure, sealed at the bottom and designed for the dewatering operation, that surrounds the excavated area of a structure. The Contractor shall use steel sheet pile or interlocking steel pile cofferdams in all excavation that is under water or affected by ground water.

**Submittals and Design Requirements.** The Contractor shall submit working drawings and calculations showing the proposed methods and construction details of structural shoring or cofferdams in accordance with [Sections 6-01.9](#) and [6-02.3\(16\)](#). The Contractor shall not begin construction of structural shoring or cofferdams, nor begin excavation operations, until approval of the structural shoring submittal has been given by the Project Engineer.

Structural shoring and cofferdams shall be designed for conditions stated in this Section using methods shown in the *USS Steel Sheet Piling Design Manuals*, published by United States Steel, and Division I Section 5 of the *AASHTO Standard Specifications for Highway Bridges Sixteenth Edition - 1996* and current interims, and as described in the *Foundations and Earth Structures - Design Manual 7.2 May 1982* published by the Department of the Navy. Allowable stresses for materials shall not exceed stresses and conditions allowed by [Section 6-02.3\(17\)B](#).

The structural shoring system shall be designed for site specified conditions which shall be shown and described in the working drawings. Examples of such items that shall be shown on the structural shoring submittal and supported by calculations include, but are not limited to, the following:

1. Soil properties; heights; soil slopes; soil benches; water tables; and controlling cross sections showing adjacent existing foundations and utilities.
2. Location and weight of construction equipment adjacent to the excavation; location of adjacent traffic; and structural shoring system material properties, spacing, size, connection details, weld sizes, and embedment depths.
3. Structural shoring installation and construction sequence, procedure, length of time for procedure and time between operations; proof load testing procedure if any; deadman anchor design and geometry; no load zones; grouting material and strengths; and a list of all assumptions.
4. Methods and materials to be used to fill voids behind lagging, when soldier piles with lagging are used as structural shoring.

**Construction Requirements.** Structural shoring or cofferdams shall be provided for all excavations near completed structures (foundations of bridges, walls, or buildings), near utilities, and near railroads.

All other excavations 4-feet or more in depth shall either be shored with structural shoring or cofferdams, or shall meet the open-pit requirements of [Section 2-09.3\(3\)B](#).

Existing foundations shall be supported with structural shoring if the excavation is within the limits defined by a plane which extends out from the nearest edge of the existing footing a level distance of  $1\frac{1}{2}$  the width of the existing footing and then down a slope of  $1\frac{1}{2}$  horizontal to 1 vertical.

When structural shoring or cofferdams are utilized, all excavation and structural shoring shall be constructed in accordance with the approved structural shoring submittal, including any required construction sequence noted in the working drawings. The Contractor shall remain responsible for satisfactory results.

If soldier piles are placed in drilled holes, then the hole shall be filled to the top of the soldier pile either with controlled density fill, if water is not present in the hole, or lean concrete. Backfilling soldier pile drilled holes with pea gravel or sand is not allowed.

If lagging is used, void space behind the lagging shall be minimized. If the Engineer determines that the voids present could result in damage or serviceability problems for the structural shoring system or any structures or facilities adjacent to the structural shoring system, the Contractor shall cease excavation and lagging installation, and shall fill the voids specified by the Engineer in accordance with the approved structural shoring submittal. Further excavation and lagging placement shall not continue until the specified voids are filled to the satisfaction of the Engineer.

Excavation shall not proceed ahead of lagging installation by more than 4-feet or by the height that the soil will safely stand, whichever is least. For tieback shoring systems, excavation shall not proceed ahead by more than 4-feet of the tie installation and proof testing.

In using cofferdams or structural shoring, the Contractor shall:

1. Extend cofferdams well below the bottom of the excavation, and embed structural shoring as shown in the structural shoring submittal as approved by the Engineer.
2. Provide enough clearance for constructing forms, inspecting concrete exteriors, and pumping water that collects outside the forms. If cofferdams tilt or move laterally during placement, the Contractor, at no expense to the Contracting Agency, shall straighten or enlarge them to provide the required clearance.
3. Secure the cofferdam in place to prevent tipping or movement.
4. Place structural shoring or cofferdams so that they will not interfere with any pile driving required.
5. Not place any shoring, braces, or kickers inside the cofferdams and structural shoring that will induce stress, shock, or vibration to the permanent structure.
6. Vent cofferdams at the elevation commensurate with seal weight design, or as shown in the Plans.
7. Remove all bracing extending into the concrete being placed.

When the work is completed, the Contractor shall:

1. Remove all structural shoring to at least 2-feet below the finished ground line.
2. Remove all cofferdams to the natural bed of the waterway.

### **2-09.3(3)E Bearing Tests**

The Engineer may stop the excavation to make bearing tests at any time. The Contractor shall assist with these tests in any way the Engineer requires.

During any test period, the Contractor shall, at no expense to the Contracting Agency, maintain ordinary working conditions at the bottom of the hole. The Contracting Agency will pay force account for all labor and materials the Contractor supplies for such tests. A single test shall not exceed 72 hours.

### **2-09.3(4) Construction Requirements, Structure Excavation, Class B**

The above requirements for structure excavation Class A, shall apply also to structure excavation Class B, except as revised below. In addition, the Contractor shall follow Division 7 of these Specifications as it applies to the specific kinds of work.

The hole for any catch basin or manhole shall provide at least 1 foot of clearance between outside structural surfaces and the undisturbed earth bank.

If workers enter any trench or other excavation 4 feet or more in depth that does not meet the open pit requirements of [Section 2-09.3\(3\)B](#), it shall be shored or other safety method constructed in conformance with WISHA requirements. The Contractor alone shall be responsible for worker safety and the Contracting Agency assumes no responsibility.

The Contractor must submit six sets of plans before shoring. These must meet the plan requirements set forth in [Section 2-09.3\(3\)D](#).

Trench boxes may be used for structure excavation, Class B. Approval of trench boxes can be done by the Project Engineer provided it is not used to support adjacent traffic, existing footings, or other structures. The Contractor shall submit three sets of the manufacturer's certified trench box plans containing Professional Engineer's stamp and seal, depth restrictions, and serial number for field verification of trench box.

Upon completing the work, the Contractor shall remove all shoring unless the Plans or the Engineer direct otherwise.

#### 2-09.4 Measurement

Excavated materials will be measured in their original position by the cubic yard. The Contracting Agency will measure and pay for only the material excavated from inside the limits this section defines. If the Contractor excavates outside these limits or performs extra excavation as described in [Section 2-09.3\(3\)B](#), it shall be considered for the Contractor's benefit and shall be included in the cost of other bid items.

**Horizontal Limits.** The Contracting Agency will use the sides of the trench or pit as horizontal limits in measuring excavation. No payment for structure excavation will be made for material removed (1) more than 1 foot outside the perimeter of any pile cap, footing, or seal, (2) more than 3 feet beyond the roadway side of a wing wall, and (3) more than 1 foot beyond the other sides and end of a wing wall.

For all pipes, pipe arches, structural plate pipes, and underpasses, the structure excavation quantity will be calculated based on the following trench widths:

For drain and underdrain pipes, trench width = I.D. + 12 inches.

For pipes 15-inches and under, trench width = I.D. + 30 inches.

For pipes 18 inches and over, trench width = (1.5 x I.D.) + 18 inches.

For a manhole, catch basin, grate inlet, or drop inlet, the limits will be 1 foot outside the perimeter of the structure.

For drywells, the limits shall be in accordance with the Standard Plans.

**Lower Limits.** For a pile cap, footing, or seal, the bottom elevation shown in the Plans, or set by the Engineer, will serve as the lower limit in measuring structure excavation. For a wing wall, the lower limit will follow a line parallel to the bottom and 1 foot below it. Any swell from pile driving will be excluded from excavation quantities.

For pipelines the bottom outside of the pipe will serve as the lower limit for measuring excavation. The Engineer may set another limit when excavation must be made below grade.

**Upper Limits.** The top surface of the ground or streambed as the work begins will be the upper limit for measuring excavation. If the Contract, or a separate contract, includes a pay item for grading to remove materials, the upper limit will be the neat lines of the grading section shown in the Plans.

The Engineer may order the Contractor to partially build the embankment before placing pipe. In this case, the upper limit for measurement will be not more than 4-feet above the invert of the pipe. For a structural plate pipe, pipe arch, or underpass, the upper limit will be the top of the embankment at the time of installation as specified in [Section 7-03.3\(1\)A](#).

**Gravel Backfill.** Gravel backfill, except when used as bedding for culvert, storm sewer, sanitary sewer, manholes, and catch basins, will be measured by the cubic yard in place determined by the neat lines required by the Plans.

**Shoring or Extra Excavation.** No specific unit of measurement shall apply to the lump sum item of shoring or extra excavation Class A. Shoring or extra excavation Class B will be measured by the square foot as follows:

The area for payment will be one vertical plane measured along the centerline of the trench, including structures. Measurement will be made from the existing ground line to the bottom of the excavation and for the length of the work actually performed. If the contract includes a pay item for grading to remove materials, the upper limit for measurement will be the neat lines of the grading section shown in the Plans. The bottom elevation for measurement will be the bottom of the excavation as shown in the Plans or as otherwise established by the Engineer.

Controlled density fill will be measured by the cubic yard for the quantity of material placed per the producer's invoice.

## 2-09.5 Payment

Payment will be made in accordance with [Section 1-04.1](#), for the following bid items when they are included in the proposal:

“Structure Excavation Class A”, per cubic yard.

“Structure Excavation Class B”, per cubic yard.

“Structure Excavation Class A Incl. Haul”, per cubic yard.

“Structure Excavation Class B Incl. Haul”, per cubic yard.

Payment for reconstruction of surfacing and paving within the limits of structure excavation will be at the applicable unit prices for the items involved.

If the Engineer orders the Contractor to excavate below the elevations shown in the plans, the unit contract price per cubic yard for “Structure Excavation Class A or B” will apply. But if the Contractor excavates deeper than the plans or the Engineer requires, the Contracting Agency will not pay for material removed from below the required elevations. In this case, the Contractor, at no expense to the Contracting Agency, shall replace such material with concrete or other material the Engineer approves.

“Shoring or Extra Excavation Cl. A \_\_\_\_\_”, lump sum.

When extra excavation is used in lieu of constructing the shoring, cofferdam or caisson, the lump sum contract price shall be full pay for all excavation, backfill, compaction, and other work required. If select backfill material is required for backfilling within the limits of structure excavation, it shall also be required as backfill material for the extra excavation at the Contractor's expense.

If it is necessary to place riprap outside of cofferdams to repair local scour, it shall be paid by agreed price or force account.

If the Engineer requires shoring, cofferdams, or caissons when the contract provides no bid item for such work, the Contracting Agency will pay as provided in [Section 1-04.4](#).

If the Engineer requires the Contractor to build shoring or extra excavation Class A that extends below the elevation shown in the Plans, the Contracting Agency will pay the lump sum price and no more when the extra depth does not exceed 3-feet. For depths greater than 3 feet below the elevations shown, payment will be as provided in [Section 1-04.4](#).

“Shoring or Extra Excavation Class B”, per square foot.

The unit contract price per square foot shall be full pay for all excavation, backfill, compaction, and other work required when extra excavation is used in lieu of constructing shoring. If select backfill material is required for backfilling within the limits of the structure excavation, it shall also be required as backfill material for the extra excavation at the Contractor’s expense.

If there is no bid item for shoring or extra excavation Class B on a square foot basis and the nature of the excavation is such that shoring or extra excavation is required as determined by the Engineer, payment to the Contractor for the work will be made in accordance with [Section 1-04.4](#).

“Gravel Backfill (\_\_\_\_\_ )”, per cubic yard.

“Controlled Density Fill”, per cubic yard.



## 2-10 DITCH EXCAVATION

### 2-10.1 Description

This work consists of excavating open ditches to the required lines, grades, and cross-sections. The work also includes disposing of all excavated material regardless of its nature or type.

**Ditch Excavation:** Includes all excavation in open ditches less than 8 feet wide at the bottom, but excludes ditches that are part of the roadway. Ditches 8 or more feet wide at the bottom shall be constructed in accordance with the requirements of [Section 2-03.3\(14\)M](#).

### 2-10.2 Vacant

### 2-10.3 Construction Requirements

Before excavating any open ditch, the Contractor shall clear and grub the area as required by [Section 2-01](#).

The Contractor may build dikes or berms with excavated material, or may dispose of it as the Plans or the Engineer requires.

### 2-10.4 Measurement

Ditch excavation will be measured by the cubic yard in its original site, and the quantities calculated by the neat lines of the staked cross-sections.

### 2-10.5 Payment

Payment will be made in accordance with [Section 1-04.1](#), for the following bid item when included in the proposal:

“Ditch Excavation”, per cubic yard.

For hauling, the Contracting Agency will pay the unit contract price for hauling excavated material ([Section 2-04](#)). If the pay item for excavation includes haul, the unit contract price per cubic yard shall cover all costs for hauling the material any distance required.

## 2-11 TRIMMING AND CLEANUP

### 2-11.1 Description

This work consists of dressing and trimming the entire roadway(s) improved under the contract, including frontage roads, connecting ramps, auxiliary lanes, and approach roads. This work extends to roadbeds, shoulders, and ditches.

### 2-11.2 Vacant

### 2-11.3 Construction Requirements

#### **The Contractor shall:**

1. Trim shoulders and ditches to produce smooth surfaces and uniform cross-sections that conform to the grades set by the Engineer.
2. Open and clean all channels, ditches, and gutters to ensure proper drainage.
3. Dress the back slope of any ditch or borrow pit that will remain adjacent to the roadway. Round off the top of the back slope and distribute the material evenly along its base.
4. Remove and dispose of all weeds, brush, refuse, and debris that lie on the roadbed, shoulders, ditches, and slopes.
5. Remove from paved shoulders all loose rocks and gravel.
6. Distribute evenly along the embankment any material not needed to bring the shoulders to the required cross-section.

#### **The Contractor shall not:**

1. Use heavy equipment (tractors, graders, etc.) to trim the shoulders of an existing or new bituminous surface.
2. Drag, push, or scrape shoulder material across completed surfacing or pavement.

When the contract requires the Contractor to rebuild part of a roadway only the rebuilt areas shall be trimmed and cleaned up. If the Contractor's work obstructs ditches or side roads, they shall be cleared and the debris disposed of as the Engineer directs.

### 2-11.4 Measurement

No specific unit of measurement shall apply to the lump sum item of trimming and cleanup.

### 2-11.5 Payment

Payment will be made in accordance with [Section 1-04.1](#), for the following bid item when it is included in the proposal:

“Trimming and Cleanup”, lump sum.

## 2-12 CONSTRUCTION GEOTEXTILE

### 2-12.1 Description

The Contractor shall furnish and place construction geotextile in accordance with the details shown in the Plans.

### 2-12.2 Materials

Materials shall meet the requirements of the following section:

Construction Geotextile

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Geotextile roll identification, storage, and handling shall be in conformance to ASTM D 4873. During periods of shipment and storage, the geotextile shall be stored off the ground. The geotextile shall be covered at all times during shipment and storage such that it is fully protected from ultraviolet radiation including sunlight, site construction damage, precipitation, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 160 F, and any other environmental condition that may damage the physical property values of the geotextile.

Unless specified otherwise in the Plans, the geotextile required for underground drainage shall be "Moderate Survivability" and "Drainage Class C" and permanent erosion control applications shall be "High Survivability" and "Drainage Class C."

### 2-12.3 Construction Requirements

The area to be covered by the geotextile shall be graded to a smooth, uniform condition free from ruts, potholes, and protruding objects such as rocks or sticks. The geotextile shall be spread immediately ahead of the covering operation. The geotextile shall not be left exposed to sunlight during installation for a total of more than 14 calendar days. The geotextile shall be laid smooth without excessive wrinkles. Under no circumstances shall the geotextile be dragged through mud or over sharp objects which could damage the geotextile. The cover material shall be placed on the geotextile such that the minimum initial lift thickness required will be between the equipment tires or tracks and the geotextile at all times. Construction vehicles shall be limited in size and weight, to reduce rutting in the initial lift above the geotextile, to not greater than 3 inches deep to prevent overstressing the geotextile. Turning of vehicles on the first lift above the geotextile will not be permitted.

Soil piles or the manufacturer's recommended method, shall be used as needed to hold the geotextile in place until the specified cover material is placed.

Should the geotextile be torn, punctured, or the overlaps or sewn joints disturbed, as evidenced by visible geotextile damage, subgrade pumping, intrusion, or roadbed distortion, the backfill around the damaged or displaced area shall be removed and the damaged area repaired or replaced by the Contractor at no expense to the Contracting Agency. The repair shall consist of a patch of the same type of geotextile placed over the damaged area. The patch shall overlap the existing geotextile from the edge of any part of the damaged area by the minimum required overlap for the application.

If geotextile seams are to be sewn in the field or at the factory, the seams shall consist of one row of stitching unless the geotextile where the seam is to be sewn does not have a selvage edge. If a selvage edge is not present, the seams shall consist of two parallel rows of stitching, or shall consist of a J-seam, Type SSn-1, using a single row of stitching. The two rows of stitching shall be 1.0 inch apart with a tolerance of plus or minus 0.5 inch and shall not cross except for restitching. The stitching shall be a

lock-type stitch. The minimum seam allowance, i.e., the minimum distance from the geotextile edge to the stitch line nearest to that edge, shall be  $1\frac{1}{2}$ -inches if a flat or prayer seam, Type SSa-2, is used. The minimum seam allowance for all other seam types shall be 1.0 inch. The seam, stitch type, and the equipment used to perform the stitching shall be as recommended by the manufacturer of the geotextile and as approved by the Engineer.

The seams shall be sewn in such a manner that the seam can be inspected readily by the Engineer or a representative. The seam strength will be tested and shall meet the requirements stated herein.

### **2-12.3(1) Underground Drainage**

Trench walls shall be smooth and stable. The geotextile shall be placed in a manner which will ensure intimate contact between the soil and the geotextile (i.e., no voids, folds, or wrinkles).

The geotextile shall either be overlapped a minimum of 12 inches at all longitudinal and transverse joints, or the geotextile joints shall be sewn for medium survivability drainage applications. In those cases where the trench width is less than 12 inches, the minimum overlap shall be the trench width.

In moderate survivability geotextile underdrain applications, the minimum overlap shall be 12 inches, or the geotextile joints shall be sewn, except where the geotextile is used in area drains. An area drain is defined as a geotextile layer placed over or under a horizontal to moderately sloping layer of drainage aggregate. For area drains, the geotextile shall be overlapped a minimum of 2 feet at all longitudinal and transverse joints, or the geotextile joints shall be sewn together. The minimum initial lift thickness over the geotextile in the area drain shall be 12 inches.

In all cases, the upstream geotextile sheet shall overlap the next downstream sheet.

### **2-12.3(2) Separation**

The geotextile shall either be overlapped a minimum of 2 feet at all longitudinal and transverse joints, or the geotextile joints shall be sewn together. The initial lift thickness shall be 6 inches or more.

### **2-12.3(3) Soil Stabilization**

The geotextile shall either be overlapped a minimum, of 2 feet at all longitudinal and transverse joints, or the geotextile shall be sewn together. The initial lift thickness shall be 12 inches or more. Compaction of the first lift above the geotextile shall be by Method A ([Section 2-03.3\(14\)C](#)). No vibratory compaction will be allowed on the first lift.

### **2-12.3(4) Permanent Erosion Control and Ditch Lining**

Unless otherwise specified in the Plans, the geotextile shall either be overlapped a minimum of 2 feet at all longitudinal and transverse joints, or the geotextile joints shall be sewn together. If overlapped, the geotextile shall be placed so that the upstream strip of geotextile will overlap the next downstream strip. When placed on slopes, each strip shall overlap the next downhill strip.

Placement of aggregate and riprap or other cover material on the geotextile shall start at the toe of the slope and proceed upwards. The geotextile shall be keyed at the top and the toe of the slope as shown in the Plans. The geotextile shall be secured to the slope, but shall be secured loosely enough so that the geotextile will not tear when the riprap or other cover material is placed on the geotextile. The geotextile shall not be keyed at the top of the slope until the riprap or other cover material is in place to the top of the slope.

All voids in the riprap or other cover material that allow the geotextile to be visible shall be backfilled with quarry spalls or other small stones, as designated by the Engineer, so that the geotextile is completely covered. When an aggregate cushion between the geotextile and the riprap or other cover material is required, it shall have a minimum thickness of 12 inches.

An aggregate cushion will be required to facilitate drainage when hand placed riprap, sack riprap, or concrete slab riprap, as specified in [Sections 9-13.2, 9-13.3, or 9-13.4](#), respectively, is used with the geotextile.

Grading of slopes after placement of the riprap or other cover material will not be allowed if grading results in stone movement directly on the geotextile. Under no circumstances shall stones with a weight of more than 100 pounds be allowed to roll downslope. Stones shall not be dropped from a height greater than 3 feet above the geotextile surface if an aggregate cushion is present, or 1 foot if a cushion is not present. Lower drop heights may be required if geotextile damage from the stones is evident, as determined by the Engineer. If the geotextile is placed on slopes steeper than 2:1, the stones shall be placed on the slope without free-fall for moderate survivability, high survivability, and ditch lining geotextiles.

#### **2-12.4 Measurement**

Construction geotextile, with the exception of temporary silt fence geotextile and underground drainage geotextile used in trench drains, will be measured by the square yard for the ground surface area actually covered.

Underground drainage geotextile used in trench drains will be measured by the square yard for the perimeter of drain actually covered.

#### **2-12.5 Payment**

Payment will be made in accordance with [Section 1-04.1](#), for each of the following bid items that are included in the proposal:

“Construction Geotextile for Underground Drainage,” per square yard.

“Construction Geotextile for Separation,” per square yard.

“Construction Geotextile for Soil Stabilization,” per square yard.

“Construction Geotextile for Permanent Erosion Control,” per square yard.

“Construction Geotextile for Ditch Lining,” per square yard.

Sediment removal behind silt fences will be paid by force account under temporary water pollution/erosion control. If a new silt fence is installed in lieu of sediment removal, the silt fence will be paid for at the unit contract price per linear foot for “Construction Geotextile for Temporary Silt Fence.”

